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TECHNICAL

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

EVALUATION OF DIAPHRAGMS ON INSTITUTE AND PERKINS MULLEN TESTERS

Project 2694-4

Report Three

A Progress Report

to

TECHNICAL DIVISION
FOURDRINIER KRAFT BOARD INSTITUTE, INC.

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SUMMARY

B. F. Perkins, Division of Standard International Corporation, recently submitted twenty diaphragms from a production run at the Chicago Rawhide Manufacturing Company for evaluation at the Institute. The diaphragms were evaluated for diaphragm pressure on two testers, namely: (1) the Institute's Model AH, and (2) B. F. Perkins' Model A Mullen tester. Prior to the evaluation, the two testers were calibrated and were found to give closely comparable diaphragm pressure results.

When the production diaphragms were evaluated the results indicated that the characteristics of the diaphragms changed slightly from trial-to-trial. It is speculated that the repeated testing and wiping of the diaphragm may have removed mold release agents from the diaphragm surface, increasing the friction and, hence, diaphragm pressures on repeated retests.

Initially, most of the diaphragms exhibited pressures in the 26-30 p.s.i.g. range – within the Rule 41 requirements of 23 to 30 p.s.i.g. at 3/8-in. distension.

INTRODUCTION

For some time The Institute of Paper Chemistry has cooperatively worked with B. F. Perkins, Div. of Standard International Corporation, in the evaluation of Jumbo Mullen diaphragms supplied to the industry. The objective of the project is to assist the manufacturer in the evaluation of diaphragm pressure characteristics in order to insure that diaphragms supplied to the industry meet Rule 41 requirements.

Twenty diaphragms from a recent production batch were recently evaluated at the Institute. Two testers equipped with automatic diaphragm distension devices were employed as follows:

1. Institute tester: Model AH Mullen tester
2. Perkins' tester: Model A Mullen tester

Prior to evaluating the twenty diaphragms, the two testers were calibrated and found to give closely comparable diaphragm pressure results.

PROCEDURES

The diaphragms were manufactured by the Chicago Rawhide Manufacturing Company. They were arbitrarily divided into two groups by cavity number as follows:

1. Group 1: Cavity numbers 1, 4, 10, 16, 20, 22, 9, 9x, 15, 15x
2. Group 2: Cavity numbers 2, 5, 11, 18, 21, 24, 14, 14x, 25, 25x

Note: The second diaphragm from a given cavity is denoted by the letter x.

Each diaphragm in Group 1 was first evaluated on the Institute's tester and then on the Perkins' tester. Both tests were carried out on 2-6-70. On 2-9-70 the Group 1 diaphragms were retested on the Institute's tester.

Each diaphragm in Group 2 was tested first on the Perkins' tester and then on the Institute's tester. Both tests were carried out on 2-6-70. On 2-9-70 the Group 2 diaphragms were retested on the Perkins' tester.

Each diaphragm was evaluated as follows:

1. Attach a 120 p.s.i.g. with rubber coupling to the tester.
2. Insert the diaphragm in the tester using a clamping force of 1000 lb. when tightening the clamping ring. [Note: The Perkins' tester has no provision for measuring clamping pressure; therefore, the clamping ring was hand tightened to firmly clamp the diaphragm.]
3. Adjust the diaphragm so that its top surface is level with the top of the bottom platen.
4. Distend the diaphragm to 0.71 inch ten times.
5. Check the level of the diaphragm and adjust if necessary.

6. Distend the diaphragm five times to 0.375-inch distension. Record the reading and average.

DISCUSSION OF RESULTS

The results obtained are summarized in Table I where the numeral in parentheses under the tester heading indicates the order of testing. The results obtained on the diaphragms tested first on the Institute and second on the Perkins' tester (Group 1) show an average difference of 1.2 p.s.i.g. between I.P.C. and Perkins' testers. The Perkins' tester gave the higher results in all cases. When the diaphragms were retested on the I.P.C. tester, the results averaged 1.3 p.s.i.g. higher than in the first trial on the same tester. The results in Group 2 exhibit the same general trends – i.e., lower results were obtained on the tester used to first test the diaphragms. Also, the retest results on the Perkins' tester were higher (1.4 p.s.i.g. on average) than in the first trial.

Therefore, these results strongly suggest that the characteristics of the diaphragm change slightly from trial-to-trial. It is speculated that the repeated testing and wiping of the diaphragm may be removing mold release agents from the surface, increasing the coefficient of friction between diaphragm and platen surfaces. The resulting increased friction could result in slightly higher diaphragm pressures on repeated retests. Chicago Rawhide Manufacturing Company is being contacted by the B. F. Perkins Division of Standard International Corporation to determine the mold release agent being used and if any remedial slip can be instituted.

With regard to diaphragm pressure level, it may be noted that most of the diaphragms initially exhibited pressures in the 26-30 p.s.i.g. range. Thus,

TABLE I

DIAPHRAGM PRESSURE RESULTS

Group 1

No.	Diaphragm Pressure, p.s.i.g. I.P.C. (1)	Perkins (2)	Diff., P2-I1	I.P.C. (3)	Diff., I3-P2	Diff., I3-I1
1	29.3	30.3	+1.0	29.8	-0.5	+0.5
4	26.5	28.9	+2.4	28.8	-0.1	+2.3
10	28.1	30.0	+1.9	30.5	+0.5	+2.4
16	28.9	29.5	+0.6	29.9	+0.4	+1.0
20	29.2	30.1	+0.9	30.9	+0.8	+1.7
22	27.6	29.1	+1.5	28.9	-0.2	+1.3
9x	28.3	29.5	+1.2	29.3	-0.2	+1.0
9	30.1	30.6	+0.5	30.2	-0.4	+0.1
15x	29.7	30.1	+0.4	31.0	+0.9	+1.3
15	28.4	29.5	+1.1	29.8	+0.3	+1.4
Av.	28.6	29.8	+1.2	29.9	+0.1	+1.3

Group 2

No.	Diaphragm Pressure, p.s.i.g. I.P.C. (2)	Perkins (1)	Diff., I2-P1	Perkins (3)	Diff., I2-P3	Diff., P3-P1
2	29.1	28.4	+0.7	28.4	+0.7	0.0
5	29.4	28.2	+1.2	29.6	-0.2	+1.4
11	31.5	29.7	+1.8	32.0	-0.5	+2.3
19	29.4	29.1	+0.3	30.5	-1.1	+1.4
21	30.6	29.1	+1.5	30.4	+0.2	+1.3
24	28.3	26.7	+1.6	28.4	-0.1	+1.7
14	28.0	26.4	+1.6	28.6	-0.6	+2.2
14x	29.5	28.9	+0.6	30.1	-0.6	+1.2
25x	29.7	29.1	+0.6	30.3	-0.6	+1.2
25	31.4	30.5	+0.9	31.2	+0.2	+0.7
Av.	29.7	28.6	+1.1	30.1	-0.3	+1.4
Composite av.	29.2	29.2		29.9		

they would be in compliance with Rule 41 requirements. After the third recheck determination, ten of the diaphragms exhibited pressures slightly above 30 p.s.i.g. In normal test use, however, the working of the diaphragm would normally reduce the diaphragm pressure to some extent.

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